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ABSTRACT

Pension reforms, required to address the financial challenge of an ageing population, involve changing the accrual rate or the indexation rates. The accrual rate is the rate at which pension benefit is built up for each year of work. The indexation rate is the rate at which pension benefit is tied to the nominal wage growth. In this paper, we study the prospective consequences of indexation and accrual reforms and show the existence of a tension between democracy and equality. Simulating the effects of long-term budget balancing reforms, we show that 80% of the population prefers accrual over indexation reforms, with the implication that the youngest half of the population would bear 85% of the total adjustment cost. Then, we consider alternative pension reforms improving the generational balance (including policy mix and contribution reforms), and we show that all those reforms fail to get majority support. Finally we show that even though indexation reform is preferable in terms of work incentives, that does not change vote incentives. So, the tension is also between democracy and efficiency.

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INTERGENERATIONAL CONSEQUENCES OF PENSION REFORMS: TENSION BETWEEN DEMOCRACY AND EQUALITY

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Intergenerational consequences of pension reforms: Tension between democracy and equality

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February 11, 2022

Abstract

Pension reforms, required to address the financial challenge of an ageing population, involve changing the accrual rate or the indexation rates. The accrual rate is the rate at which pension benefit is built up for each year of work. The indexation rate is the rate at which pension benefit is tied to the nominal wage growth. In this paper, we study the prospective consequences of indexation and accrual reforms and show the existence of a tension between democracy and equality. Simulating the effects of long-term budget balancing reforms, we show that 80% of the population prefers accrual over indexation reforms, with the implication that the youngest half of the population would bear 85% of the total adjustment cost. Then, we consider alternative pension reforms improving the generational balance (including policy mix and contribution reforms), and we show that all those reforms fail to get majority support. Finally we show that even though indexation reform is preferable in terms of work incentives, that does not change vote incentives. So, the tension is also between democracy and efficiency.

Keywords: Pension reform, Ageing, Generational balance, Prospective incidence, Indexation, Fiscal balance

JEL Codes: D63, D64, H55, I38

1 Introduction

Many public pension schemes around the world involve Pay-As-You-Go (hereafter, PAYG) schemes. In ageing societies, those PAYG schemes are under pressure. For a PAYG scheme to avoid running a structural deficit, it has to ensure that the revenue flowing into the scheme from current contributors covers the expenditure required for the payment of benefits to current retirees. The retirement of the baby boom generations increases the ratio of current beneficiaries to current contributors, making current pension schemes unsustainable. "Member states should undertake ambitious reforms of pension systems in order to contain pressures on public finances, to place pension systems on a sound financial footing and ensure a fair intergenerational balance" (European Commission, 2003, p. 61). If we believe that passing on to the next generation an excessively large fiscal burden is unfair – just as it is unfair to overexploit natural resources or run down "natural capital", then the interests of future generations should be appropriately accounted for in any pension reform. Our objective is to study in a transparent way the prospective consequences of any pension reforms not only for those currently retired or near retirement but for all generations currently alive (European Commission, 2021).

To address the pension burden challenge, many countries are reforming their pension systems. There are three possible options: adapting the contribution rate, changing the pension benefit or adjusting the retirement age. The choice between them is to certain extent arbitrary. There is also a more radical policy option which is to switch from unfunded to funded pension systems (Kotlikoff and Burns, 2004). We do not consider this option as generationally fair because it imposes on transitional generations the obligation to finance the two (pension) schemes at the same time (Miles, 1998). The literature often puts the focus on the choice (and the optimal mix) of those three options, without carefully analyzing the age specific and cohort specific consequences of those pension policies. This is particularly problematic as there is empirical evidence that countries have not treated cohorts equitably by adopting grandfathering approach in their pension reforms, namely reducing pension entitlement for younger generations while sparing those near retirement (Börsch-Supan, 2013; Fouejieu et al., 2021). Therefore, a generational conflict could emerge from those reforms - challenging their political sustainability (Kotlikoff and Burns, 2004). Chen et al. (2018) also show that the youth and the working age population bear most of the cost of previous crises. Reforms should aim not only at fiscal sustainability, but also at some generational balance (Barr and Diamond, 2008; Kohli and Arza, 2011).

Generational fairness is the means by which policy makers assess the acceptability of their reforms to present and future retirees. Our criterion for generational fairness will be the equal treatment of all cohorts when adjusting the pensions to cope with population ageing. The difficulty we face is that cohorts currently alive have different remaining lifetimes. The Generational account deals with this difficulty by restricting attention to generations not yet born so that they all have a full lifetime ahead (Auerbach et al., 1994; Kotlikoff, 2003). By contrasts, we will restrict attention to all cohorts currently alive. We assess the prospective consequences for all generations currently alive of different pension policies. We will define equal treatment in terms of pension loss relative to the status quo. There are two key differences with generational accounting. First, instead of calculating the implicit tax burden from existing fiscal policy on generations not yet born given existing policy, we measure the unequal consequences of various pension reforms for the generations already born over their remaining lifetime. Second, we assess the impact of the pension reforms relative to the status quo over a finite horizon, instead of taking proper account of all age-related social transfers as in the generational accounting to compute the discounted lifetime net tax payment over infinite horizon (Banks et al., 1999).

In a nutshell, the pension reform affects pension benefits, and so computing the expected reduction of pension benefits to balance the inter-temporal budget is an effective way of measuring the reform impact for different generations. Furthermore since welfare analysis of pension reforms consequences on different cohorts with unequal remaining lifetimes is problematic (see Bommier et al., 2011), we will limit our analysis to an actuarial evaluation of the pension reform.

In most pension schemes (either defined benefit, point systems or Notional Defined Contribution schemes), pension benefits are governed by two key parameters: the indexation rate and the accrual rate. Pre-retirement indexation guarantees that early wages are tied to the wage growth rate, while post-retirement indexation ensures that pension benefits remain in line with wage growth. Various papers analyzes the budgetary pros and cons of indexing relative to wages or to prices (see e.g. Blanchet et al., 2016) and the timing of indexation (before and/or after retirement) (see e.g. Whitehouse, 2009; Piggott et al., 2009). Partial indexation erodes pensions overtime and can put older retirees in poverty (Hohnerlein, 2019). In this paper we compare the prospective consequences for all generations currently alive of changing the indexation rule and/or the accrual rate. These two pension policies have been widely used in many pension reforms around the world. For instance, in Poland existing pensions are indexed with the inflation rate plus 20% of real wage growth. In France, pensions are indexed to prices only while in Germany indexation is adjusted to the growth of wage minus the growth of the ratio of contributors to retirees (sustainability factor).

This paper proceeds as follows. Section 2 presents the model. Section 3 illustrates the issues with simple example. Section 4 describes the economic and demographic data used in our simulations of various pension reforms. We show the conflict of preferences over indexation and accrual reforms in Section 5. Section 6 considers alternative pension reforms that improve generational balances but face political resistance, pointing out the democracy-equality tension. Section 7 provides several extensions and then, we conclude.

2 The model

Our simulations work as follows. At time t, the set of working age cohorts s is denoted W_t and the set of retired cohorts (still alive) is denoted R_t. The size of each cohort s in time t is N_t^s. Cohort size evolves over time as

$$N_t^s = (1 - \mu_t^s) N_{t-1}^s \tag{1}$$

where μ_t^s is the mortality rate of cohort s in year t. Total employment is

$$N_t^E = \sum_{s \in W_t} e_t^s N_t^s \tag{2}$$

where $e_t^s \in [0, 1]$ is the employment rate of cohort $s \in W_t$ in time t, so the employment rate evolves over time and across cohorts. The total retired population is

$$N_t^R = \sum_{s \in R_t} N_t^s. \tag{3}$$

The dependency ratio in time t is:

$$D_t = \frac{N_t^R}{N_t^E} \tag{4}$$

At time t, for each working age cohort $s \in W_t$, the pension entitlement (P_t^s) is the pension entitlement of time $t - 1$ indexed at rate r_t^0 to the (nominal) wage growth, plus the pension entitlement earned in time t according to the accrual rate a_t. So, a decrease in accrual rate will not change the replacement rate of those already retired but it will decrease the replacement rate of the future retirees.

$$P_t^s = P_{t-1}^s r_t^0 \frac{w_t}{w_{t-1}} + a_t w_t \tag{5}$$

At retirement, the pension entitlement gives the amount of the pension benefit. For each retired cohort s, pension benefit at time t is the pension benefit in $t - 1$

indexed at rate r_t^1 to the (nominal) wage growth. In case of partial indexation of pensions on wage growth $r_t^1 < 1$, t the replacement rates decreases with age (erosion of pension benefit). Note that the indexation rate may differ between the working population and the retired population (e.g. dual indexation).

$$P_t^s = P_{t-1}^s r_t^1 \frac{w_t}{w_{t-1}} \tag{6}$$

We define the replacement rate ρ_t^s of the retired cohort $s \in R_t$ in time t as:

$$\rho_t^s = \frac{P_t^s}{w_t} \tag{7}$$

Note that there is a difference between the *replacement rate* and the *benefit ratio*. The benefit ratio measures the average replacement rates among the retired population. At time t, the benefit ratio is:

$$\beta_t = \sum_{s \in R_t} \rho_t^s \frac{N_t^s}{N_t^R} \tag{8}$$

The short term cash flow budget balance in time t is given by

$$\beta_t D_t = \tau_t \tag{9}$$

where τ_t is the contribution rate. Our simulation adopts a long term budget balance perspective. This means that the pension system should be in equilibrium on average during the period 2020-2100. We simulate an one-off permanent change in year 2020 in either the indexation or accrual rate. The initial pension parameters are (a_0, r_0) and, depending on the reform, change to a_1 or r_1. We set r_0 to 1 (i.e. full indexation to the wage growth) and a_0 to achieve budget balance in 2019. We then consider either an one-off permanent accrual cut $a_1 < a_0$ or a one-off permanent indexation cut $r_1 < r_0$ so as to balance the long-term budget constraint in expected terms. The present value of all future pension spending must be equal to the present value of all future pension contributions.

$$\sum_{t=2020}^{2100} \sum_{s \in W_t} \tau_t w_t e_t^s N_t^s = \sum_{t=2020}^{2100} \sum_{s \in R_t} P_t^s(a_1, r_0) N_t^s = \sum_{t=2020}^{2100} \sum_{s \in R_t} P_t^s(a_0, r_1) N_t^s \qquad (10)$$

Our budget approach is twofold. First, it is based on the intertemporal budget balance and not on short term cash balance. This enables the reform to be gradually phased in. One reason for gradual implementation is to avoid large differences of benefits between new retirees from one year to the next. We disregard short term year-to-year adjustments not only to avoid the curse of dimensionality, but also to provide security of how the pension benefit will evolve in the mid/long run. Second, our budget approach is based on the principle of no perpetual deficit financing. Pension reform must bring long-run revenues and expenditures into considerations and not depends upon perpetual, long term, deficit financing that will be financed by future unborn taxpayers. The problem with the cash balance approach is that it does not take into account the fact that pension policy today will change pension commitment in the future and such budget impact ought to be measured at the time the policy is implemented (the deficit shows cash flows in the current period only). This does not mean that temporary deficit is not allowed; but only that the budget should be in equilibrium on average over the period under consideration (2020-2100).

2.1 Relative pension loss

Pension systems provide retirees with benefit throughout their retirement which requires looking towards the value of expected lifetime benefits. With a lifetime benefit perspective, it is easier to view many of the trade-offs comprehensively, notably across generations. That perspective allows to distinguish between cohorts. For instance, indexation rules affect most the pension benefits of old retirees as the pension benefits of newly retirees are closely tied to most recent wages.

We will compare the pension losses of all the cohorts alive in 2020 for each of our pension reforms. Given that successive cohorts have different remaining life expectancy, we use the relative pension loss by expressing the expected lifetime pension benefit under the reform relative to the expected lifetime pension benefit without reform using the survival probabilities for the different cohort at different age. Let us index each cohort s by its birth date so that cohort $s = t$ is the cohort born in year t. So cohort s reaches retirement age 65 in year $t = s + 65$. We define π_t^s as the probability of a member of cohort s to be alive in year $t \geq s + 65$. The expected lifetime pension loss for cohort s under accrual adjustment reform (a_1, r_0) is:

$$\Delta^s(a_1, r_0) = \frac{\sum_{t=s+65}^{100} \pi_t^s P_t^s(a_1, r_0)}{\sum_{t=s+65}^{100} \pi_t^s P_t^s(a_0, r_0)} \tag{11}$$

The expected lifetime pension loss for cohort s under indexation adjustment (a_0, r_1) is:

$$\Delta^s(a_0, r_1) = \frac{\sum_{t=s+65}^{100} \pi_t^s P_t^s(a_0, r_1)}{\sum_{t=s+65}^{100} \pi_t^s P_t^s(a_0, r_0)} \tag{12}$$

We do not use the explicit social welfare approach to compare reforms because such approach produces problematic results when people have different lifetimes (see Bommier et al., 2011). Social welfare would be biased in favour of the cohorts with longer remaining lifetimes. Indeed, given the concavity of the utility function, welfare is higher when the same pension budget B is spread over longer lifetime $m+1 > m$, $(m+1)\, U\left(\frac{B}{m+1}\right) > m\, U\left(\frac{B}{m}\right)$. We will use the Gini index to compare distributions of pension loss across cohorts. Note that the Gini index can be related to welfare measure under certain conditions. Consider a society of n individuals (n large) and individual aversion for inequality as in Fehr and Schmidt (1999). As Schmidt and Wichardt (2019) showed, simple aggregation leads to a social welfare function that can be approximated as a combination of aggregate income in society, μ, and a measure of inequality in society, namely the Gini index G. A similar result was established earlier in Sen (1974) and Porath and Gilboa (1994) without individual aversion to inequality. So the Gini index can arises naturally under certain conditions as welfare measure (see e.g. Cowell, 2016; Hindriks and Myles, 2013).

3 Example

Let us start our analysis by taking a simple example. Table 1 shows the demographic structure of some hypothetical ageing population. Individuals work for two periods and, then, with probability 0.5, retire during two periods. We assume that the initial contribution rate is set to balance the budget in time 0 and that the government will match the increasing dependency ratio by either adjusting the accrual or the indexation rates so as to balance the average pension budget over periods 1-3. The pension reform consists of cutting uniformly the accrual rate or the indexation rate for the rest of the periods (i.e., periods 1-3). The dependency ratio is 55.56% at time 0. We assume a contribution rate of 30% and a wage growth of 2% .

Period	Demographic structure				Dependency ratio	Accrual adjustment		Indexation adjustment	
	Young Workers	Old Workers	Young Retirees	Old Retirees		Young Retirees	Old Retirees	Young Retirees	Old Retirees
0	8	10	5	5	55.56%	54.00%	54.00%	54.00%	54.00%
1	6	8	5	5	71.43%	42.94%	54.00%	44.61%	44.61%
2	6	6	4	5	75.00%	31.88%	42.94%	40.74%	36.86%
3	3	6	3	4	77.78%	31.88%	31.88%	40.74%	33.66%

Table 1: Simple Illustration

The initial replacement rate is at 54% at time 0 ($a_0 = 0.54$), and the initial indexation rate is 100% ($r_0 = r_1 = 1$). The pension budget is balanced on average over periods 1 to 3 if the sum of the contributions over these periods is equal to the sum of the pension payments over the same periods. It is worth noting that the progressive phase in of the reform will only change future benefits but not past benefits (due to the stand-still restriction). Indeed by changing *once and for all*, in period 0, the accrual rate or the indexation rate for future periods 1-3, older cohorts will have a greater share of their career under the old system and the younger cohorts will have a greater share of their career under the new system.

Let us compare the two alternative reforms. Let us start by the accrual reform. At period 0 (and before), the accrual rate is $a_0 = 0.54$ and the indexation rate is $r_0 = 1$. Fixing the indexation rate $r_0 = 1$ and the contribution rate at $\tau_0 = 0.3$, the new accrual rate a_1 should be set at 31.88% for the periods 1 to 3. This means that the newly retirees in period 2 will have, given full indexation ($r_0 = 1$), a replacement rate of 42.94% ((54% + 31.88%)/2). In period 3, the new retirees will have their entire career under the new accrual rate and so will have a replacement rate of 31.88%. The transition from the old accrual rate (54%) to the new accrual rate (31.88%) is progressive.

Let us consider indexation reform. We assume uniform and constant indexation rate between retirees and workers so that $r_1 = r_0$. Fixing the accrual rate $a_0 = 0.54$ and the contribution rate at $\tau_0 = 0.3$, the indexation rate should be set at 82.62% to balance the pension budget over the periods 1-3. In period 1, the retirees have a replacement rate of 44.61% (54% × 82.62%). The new retirees have the same replacement rate. In period 2, the old retirees have a replacement rate of 36.86% (44.61% × 82.62%) and the new retirees a replacement rate of 40.74% ((54% × 82.62%^{2} + 54% × 82.62%)/2). A key feature of indexation adjustment is the pension erosion during retirement. It is the opposite with accrual reform that better protects old retirees.

4 Data

Following generational accounting, we use current cross sectional profiles to know the lifetime profiles of the current population. That does not mean that employment profiles by age group are assumed to be fixed over time. In fact there are shifts in employment rates by age group that are driven by the assumption of a continuous expansion in female labour market participation as well as in older worker labour market participation. Our analysis uses two data sets based on such lifetime profiles predictions. The first one is the projection of the Belgian population and employment rates by cohort, age group and gender for the period 2020-2070. Those projections are done by the Federal Plan Bureau. We have the population projection and the employment rates projection by year and by “5 year age” bins. We

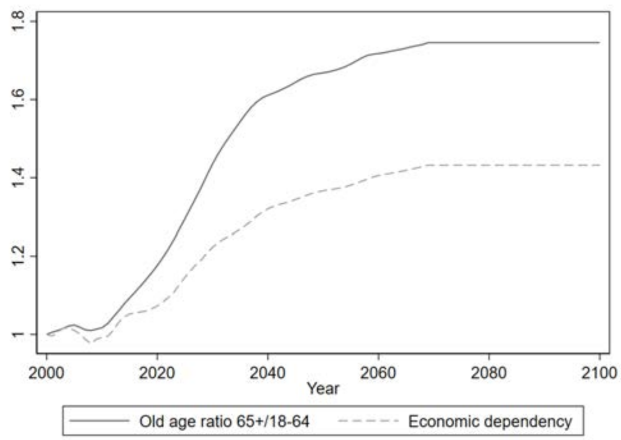

Figure 1: Economic dependency and old-age ratio (base year 2000)

Data source: Federal Plan Bureau

expand the projection to 2100. We do so in order to cover the entire life cycle of those starting their career in 2020 (reform year). The dependency ratio in Figure 1 is stable beyond 2060. We expand the projection to 2100 by assuming the same demographic structure from 2070 to 2100. This first data set enables us to compute the equilibrium indexation/accrual adjustments using (1), (2),(3), (5), (6), and (10).

The second data set is the survival probability of each age group as of 2019, taken from the Belgian Statistical Agency website (Statbel). Figure 2 shows the survival probabilities for men aged 65 and 80. This second data set is used to compute the relative pension loss using (11) and (12). The current cross sectional profile of survival probability (in 2019) is assumed to retain the same shape for successive cohorts. That does not prevent life expectancy to increase since the survival probabilities by age group used for the new cohorts are higher than the survival probabilities of older cohorts.

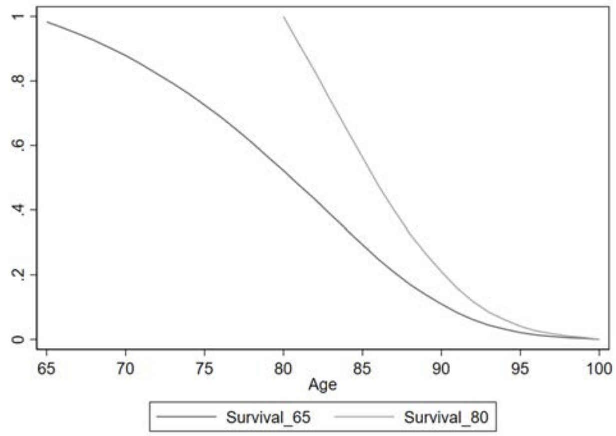

Figure 2: Survival probabilities of men at 65 and 80.

Data source: Statbel.

5 Indexation versus accrual reforms

We calculate the prospective consequences of indexation and accrual adjustments for each cohort (each cohort s is associated with a representative agent born in year $t = s$ with cohort-age specific wage and survival probabilities). We assume that each cohort works a full career lasting 45 years (so we do not consider pension policy extending the career requirement). We assume a wage growth of 2% per year and a contribution rate of $\tau_t = 30\%$. We will relax the fixed contribution assumption later to consider the distributional effect of adjusting simultaneously pensions and contributions. The pre-reform dependency ratio is 43.06% in 2019; and the pre-reform benefit ratio is 69.68% so that the pension budget is balanced at the time of the reform in 2019. The dependency ratio is expected to rise on average from 43.06% to 54.93% over the period 2020-2100, inducing for fixed contributions an average decrease in the benefit ratio from 69.68% to 54.61%. Our analysis starts by analyzing the distributional effects of balancing the pension budget exclusively with indexation or accrual adjustments to match the predicted increase of the dependency ratio over the period 2020-2100.

5.1 Accrual reform

In case of an accrual adjustment, the accrual rate is set at 45.99% (and the uniform indexation rate is set at 100% of the wage growth). Figure 3 shows the evolution of the replacement rate over time for (successive) cohorts reaching either 65, 80 or 95 years old in year t in case of an accrual adjustment. As in our simple example, the replacement rate decreases with time. It decreases until 2065 for successive cohorts reaching 65 years. In 2065, the system is totally phased in given the career length of 45 years. The replacement rate stays constant from this point on, because the following cohorts will also have their entire careers with the reduced accrual rate (45.99%). There is a parallel evolution of the replacement rate for the successive cohorts reaching 80 and 95 years old in time t. The comparison of replacement rates across different age cohorts is as follows. Consider year 2065. The 65 years cohort will have a full career (45 years) with the new accrual rate producing a replacement rate of 45.99%. The 80 years cohort will have 1/3 of its career with the old accrual rate and the rest with the new one. The 95 years cohort will have 2/3 of its career with the old accrual rate and the rest with the new one. As in our simple example, the adjustment through the accrual rate induces heterogeneous replacement rates for different cohorts of retirees during the transition. The older cohorts are less affected by the accrual adjustment.

5.2 Indexation reform

In case of an indexation adjustment, the indexation rate is put at 99.05% of the wage growth (and the accrual rate is fixed at its initial level to secure a replacement rate of 69.68% in 2020). Under indexation adjustment, the replacement rate decreases with time. However, unlike the accrual adjustment, all cohorts are impacted by the indexation adjustment. As mentioned in our simple example, indexation spreads the adjustment across all cohorts. In our simulation, the gap between the replacement rate at 65 years of the newly retired in 2020 and the future retirees in 2100 is 13.19 compared to a gap of 23.69 under the accrual rate adjustment. So, the "pension"

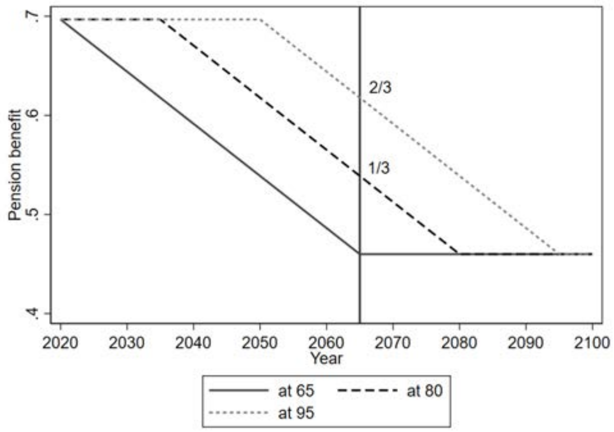

Figure 3: Replacement rates at 65, 80 and 95 by year with accrual reform

gap is halved when adjusting the pension via the indexation rather then the accrual rate. The replacement rate across cohorts and over time is illustrated in Figure 4. Under the indexation adjustment, the replacement rate of the newly retired at any time t is always higher than the replacement rate of the older retirees. The reason is that the lower indexation induces pension erosion during retirement. Therefore, indexation adjustment reduces the pension inequality between current retirees and future retirees but increases the pension inequality between young and old retirees.

5.3 Comparing pension loss

Figure 5 compares the pension loss of each cohort alive in 2020 under either the indexation reform or the accrual reform. Note that without reform there is full indexation both before and after retirement ($r_0 = r_1 = 1$) and all cohorts face the same accrual rate a_0 over their entire career. Therefore our baseline of no reform involves the same lifetime pension benefit across cohorts. The reform will impact differently the different cohorts producing a gap in lifetime pension benefit. When comparing the two reforms, Figure 5 indicates that the pension loss is larger under accrual reform for cohorts below 30 years (in 2020) and larger under the indexation

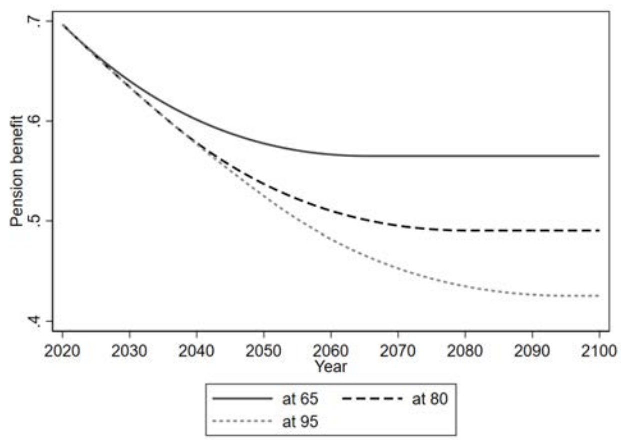

Figure 4: Replacement rates at 65, 80 and 95 by year with indexation reform

reform for cohorts above 30 years (in 2020). It means that if there was a vote on either of these two reforms, those younger than 30 years would support the indexation reform and those older than 30 years would support the accrual reform.[1] Since the median voter in 2020 in Belgium is 50 years old and so a majority of voters would support the accrual reform (in fact a majority of 80% of the voters would vote for the accrual reform).

5.4 The tension democracy-equality

The voting outcome over pension reforms looks unfair if we want to achieve some generational balance in the pension loss. The accrual reform is more "unequal" than the indexation reform. The Gini index of the pension loss is 43.07% for the accrual adjustment, whereas it is 21.56% for the indexation adjustment. To better illustrate the generational imbalance of those reforms we employ the Lorenz curve. This curve represents the proportion of the total pension loss (relative to the no reform baseline) born by the youngest $x\,\%$ of the population alive in 2020. As we see in Figure 6, 85% of the total pension loss is born by the youngest half of the

[1]We assume that people vote in favor of the reform minimizing their pension loss.

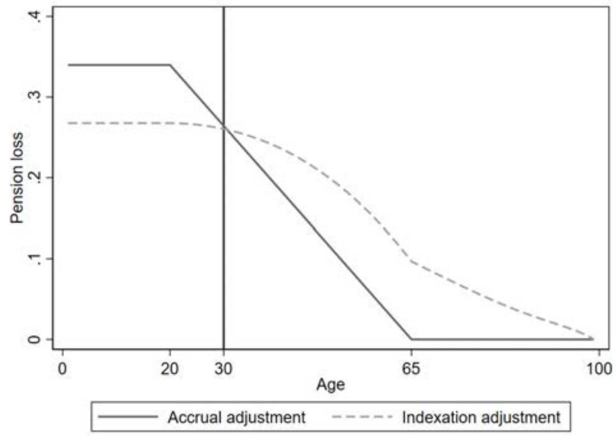

Figure 5: Pension loss (relative to status quo) as a function of cohort age in 2020

population under the accrual reform whereas it is 65% under the indexation reform. The size of such generational imbalances in sharing the burden of adjustment is striking because we impose immediate adjustment in year 2020 and also because we do not even consider the pension loss for the future generations not yet born in 2020. The tension between democracy and equality is driven by the stand still option that rules out retrospective adjustments and by the fact that the impact of the reform is proportional to the remaining lifetimes. The nature of the problem is not new. The problem of democracy is that representation is not proportional to the stakes (Brighouse and Fleurbaey, 2010). First cohorts under 20 years and the future generations are not allowed to vote even though they are affected by current reforms. If we want to reverse the voting outcome we should give a vote to people under 20 years old plus to all future generations until those born in 2036 (or use constitution rules to protect them). Second, there are people who have a vote, but their vote is not proportional to the stake of the current decision. This is a general concern with election that takes a very acute form with pension reform. In the following section, we will consider alternative pension policies that can improve the generational balance but that will face the similar tension between democracy and equality.

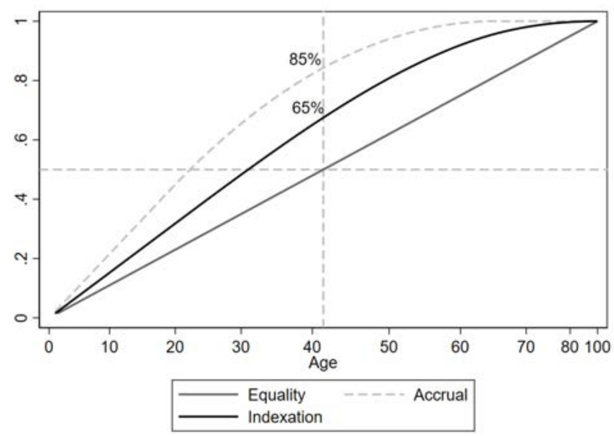

Figure 6: Proportion of total cost born by the youngest $x\%$ of the population

6 Other pension policies

So far, we have analyzed the distributional effects of using either the accrual or indexation rate adjustment in response to the increasing dependency. We have seen that both adjustments have their own drawbacks. The accrual adjustment increases the pension gap between current retirees and future retirees. Indexation adjustment increases the pension gap between young and old retirees. In this section, we consider alternative adjustments to attenuate those pension inequalities. First, we consider a policy mix (i.e. combining the accrual and indexation adjustment). Then, we analyze the dual indexation that allows to use different indexation rates before and after retirement. Third, we consider simultaneous adjustment of pension benefit and contribution rate following the "Musgrave rule" which requires a constant ratio of the pension benefit to the net wage $\frac{\beta_t}{1-\tau_t}$.

6.1 Policy Mix

It is possible to combine indexation and accrual changes in order to reduce the pension loss inequality as measured by the Gini index. We know that people already retired at the time of the reform do not contribute to the overall effort under accrual adjustment and that the pension loss is more equally distributed across cohorts with indexation adjustment. So in order to reduce the pension loss inequality, the policy mix option is to increase the accrual rate above its pre-reform level and to compensate by decreasing further the indexation rate. In doing so, the currently retirees will face greater erosion of their pension during retirement. And those currently working will benefit from the higher accrual rate. As a result, the pension loss inequality as measured by the Gini index will drop. Table 2 shows the Gini index for different policy mixes. The first two rows of the table indicate the benchmark cases, respectively accrual change only and indexation change only. The last three rows indicate various policy mixes with increasing accrual rate and decreasing indexation rate. The Gini index decreases progressively as we shift more of the adjustment from the accrual to the indexation.

	Accrual rate	Indexation rate	Gini index of the pension loss
Accrual adjustment	45.99%	100,00%	43.07%
Indexation adjustment	69.67%	99.05%	21.56%
	80.00%	98.71%	16.26%
	90.00%	98.40%	13.32%
	100.00%	98.12%	11.90%

Table 2: Policy-mix reforms and pension loss inequality

6.2 Dual indexation

Another solution to decrease pension loss inequality is to differentiate the pre-retirement and post retirement indexation rate (dual indexation). We analyse this possibility in Table 3 assuming a fixed accrual rate. The first column indicates the ratio of the post-retirement to the pre-retirement indexation rate (retirement indexation discount). To minimize pension loss inequality, this retirement indexation discounting should be large enough (since the older cohorts are less affected by the reform). We see that the Gini index decreases as this retirement indexation discount becomes larger (until 0.976).

Ratio	post-retirement indexation	pre-retirement indexation	Maximum Pension Loss	Gini index
	100.00	98.35	30.05	33.81
1.01	99.62	98.63	28.83	28.75
1.00	99.05	99.05	26.77	21.56
0.99	98.47	99.46	24.63	14.67
0.98	97.86	99.86	22.44	8.04
0.976	97.61	100.01	22.08	5.94
0.97	97.23	100.24	24.92	7.07

Table 3: Dual indexation and pension loss inequality

We can compare the pension loss distribution under dual and uniform indexation reforms in Figure 7. The figure assumes a dual indexation with a pre-retirement indexation of 1 and a post-retirement indexation of 0.96. The break even age is 46 years with those younger preferring the dual indexation and those older preferring the uniform indexation. Switching to dual indexation shifts the burden from the younger cohorts to the cohort reaching retirement age at the time of the reform. Given the current median voter age, there is almost a fifty-fifty divide between these two options.

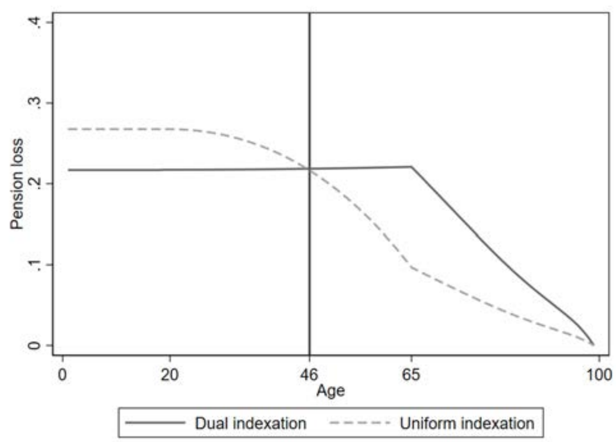

Figure 7: Pension loss (relative to status quo) - Uniform and Dual indexation reforms

6.3 Musgrave rule

So far we have fixed the contribution rate at 30%. We now relax this assumption by considering a joint adjustment of pension benefit and contribution rate. The set of possible combinations of pension benefit and contribution adjustments is infinite so we will tie down the reforms using the Musgrave rule. The Musgrave (1981) rule requires to maintain constant the ratio of the pension benefit relative to the wage net of contribution. This means that to maintain budget balance when the dependency ratio increases, both the pension benefit β_t and the contribution rate τ_t should be adjusted so as to maintain the ratio $\frac{\beta_t}{1-\tau_t}$ constant. This rule imposes equiproportional change (in opposite direction) of the contribution rate and the benefit ratio. As we have different pension benefit, we apply this rule by considering that the ratio of the pension benefit of someone aged 65 compared to the net wage should be the same before and after the reform is fully implemented.

Following this Musgrave rule, under accrual adjustment, the contribution rate increases from 30% to 37.00% and the accrual rate decreases from 69.68% to 62.71%. Under indexation adjustment, the contribution rate is 35.66% and the indexation rate is 99.62%. To compare the distributional effect of this "Musgrave" adjustment with the fixed contribution scenario, we need to add the contribution adjustment to the pension loss for those working at the time of the reform. Interestingly as shown in Figure 8, the pivotal age (around 30 years) does not change with the Musgrave adjustment. The reason is that mixing contribution increase with benefit cut does not really change the relative preference over accrual and indexation adjustments. What it does is to scale down the size of the accrual/indexation adjustment, and so the size of the pension loss for those currently working. However this is offset by the increase of their contributions. So the Musgrave reform operates a lifetime shift for the working cohort between pension and contribution without changing the conflict of preferences across cohorts.

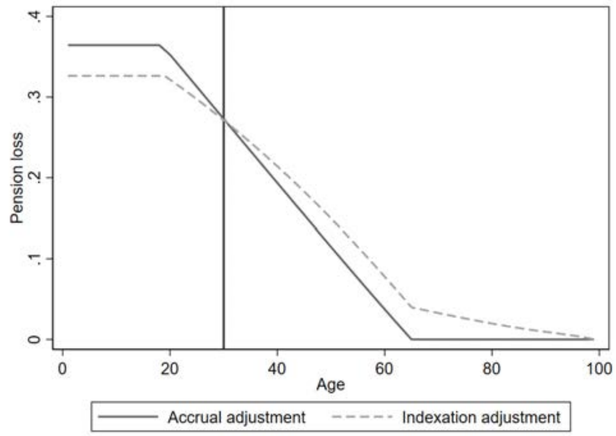

Figure 8: Pension-contribution loss (relative to status quo) with the Musgrave reform

7 Extensions

7.1 Unequal Longevity

So far we have assumed representative agent within each cohort. Introducing heterogeneity within cohorts is clearly necessary, however forecasting the life-time income and employment rates profiles of future cohorts of low and high skilled workers based on the the cross-sectional observations of the life-time profiles of the current population is problematic (Banks et al., 1999).

We will provide a first-order approximation to the case of unequal longevity within cohorts. Chetty et al. (2016) find that in the US, the gap in life expectancy between the richest 1% and poorest 1% of individuals was 14.6 years (95% CI, 14.4 to 14.8 years) for men and 10.1 years (95% CI, 9.9 to 10.3 years) for women. Eggerickx et al. (2020) find that in Belgium, the probability to reach 65 years (retirement age) is 77% for the low income group and 93% for the high income group. We introduce within cohort unequal longevity in our simulation model by indexing mortality rates from Statbel by the income-specific coefficients in Eggerickx et al. (2020). Those longevity coefficients are the delta between the average mortality rates in the population and the mortality rates specific to the low/high income groups.

Figure 9 compares the male survival probabilities in the low/high income groups. We can see that low income group faces a probability of 23% of not reaching retirement age against a probability of 7% in the high income group. The other gap is the the difference in the pension duration.

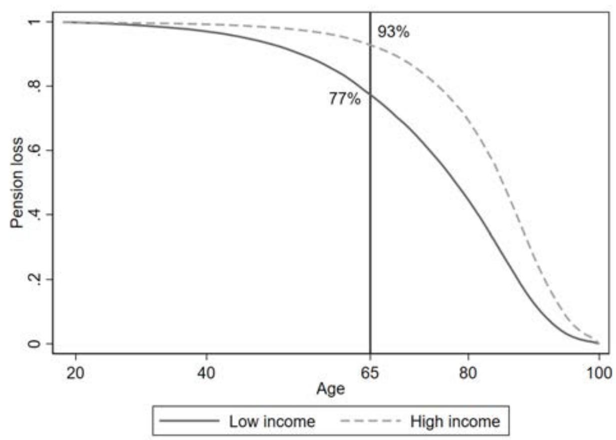

Figure 9: Survival probabilities for male in low/high income group

Data source Eggerickx et al. (2020).

Life expectancy for low socioeconomic status is 57.93 at 18 and 17.08 at 65 and is 65.83 at 18 and 20.87 for high socioeconomic status. Someone with a shorter life expectancy will prefer a higher retirement benefit at the beginning of retirement, and so she may prefer indexation adjustment to accrual adjustment. Let us compare the pension loss for both income groups. Note that the pension benefit is proportional to income and so only longevity gaps will influence pension loss between income groups. First, the loss with the accrual rate is the same for both income groups. Indeed, the pension loss depends on the sum of the probabilities of being alive at a particular age π_t^s times the retirement benefit (P_t^s) at that age ($\sum \pi_t^s P_t^s$). With an accrual adjustment (and full indexation), the pension benefit profile does not change with age. As a result, the longevity gap has no incidence on the pension loss under accrual adjustment for either income groups. However, indexation adjustment erodes pension benefits during retirement and thus the long lived (high income group) are more affected by this adjustment. Inversely, the short lived (low income group) may prefer to trade off lower indexation for higher accrual. This conjecture is confirmed in our simulation results based on Eggerickx et al. (2020)'s gap in mortality rates, with the pivotal age for supporting indexation being shifted up to 32 years against 31 years for the high income group. What is striking is that the distribution of preference over indexation and accrual adjustment does not change much even though the longevity gap in our simulation is quite high. This suggests that our tension between democracy and equality is quite robust to (growing) longevity inequality.

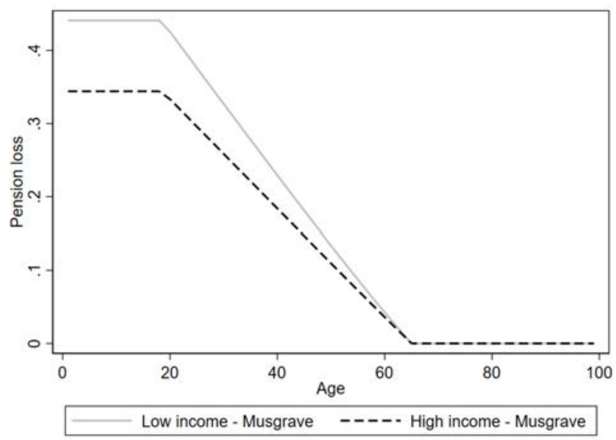

Figure 10: Pension-contribution loss by income group (male) - Musgrave

7.2 Endogenous employment: efficiency and equity

So far we have assumed exogenous employment rates. We will introduce in our simulation model some assumptions on the possible impact of the prospective pension loss on labor supply and participation rates. Indeed, we may reasonably expect the pension benefit adjustment to affect work incentive until retirement age which in turn will feed back in the pension budget constraint via the dependency ratio in (10). The pension reforms examined in the literature are disclosing a substantial overall labor supply effect on the labor of the seniors (Andersen et al., 2021; Hernæs et al., 2016). Let us assume that the pension loss reduces labor supply (the accrual or indexation adjustments are perceived as implicit tax on labour). Let us also assume that the labor supply distortion is limited to the end of the career (young workers do not really condition their labor supply to the change in their future pension benefit). We consider that the employment rate of the 60+ (labor supply in extensive margin) is related the pension benefit according to the following sufficient statistic:

$$\frac{e^0 - e^s}{e^0} = Elasticity \times Pension\, loss^s \qquad (13)$$

where e^0 is the baseline employment rate. The percentage reduction in the participation rates of cohort s (60-65 years) is proportional to their pension loss (in%). Since the pension loss differ across cohort, the change in participation rate will also differ across cohorts. Table 4 shows the change in the pivotal age, accrual and indexation rate as a function of the employment elasticity using 1-13. A higher elasticity reduces employment rates. As a consequence, the accrual/indexation adjustments should be scaled up. A higher elasticity also increases the pivotal age (i.e. relative preference for indexation adjustment). This is due to the fact that by shifting some of the adjustment cost to the cohorts currently retired, the indexation reform induces less distortion than the accrual reform. Indexation reform is less costly overall which increases pivotal age. Interestingly the indexation reform (compared to accrual reform) involves a better generational balance and creates less distortion. Equality meets efficiency with this pension reform. Unfortunately this reform is not politically acceptable because all cohorts above 30-31 years are still supporting the accrual reform. So again the political resistance of switching from accrual to indexation adjustment is robust to work incentive even though such a switch is efficient and fair.

Elasticity	Accrual rate	Employment rate of male aged 60 (2040) Accrual adjustment	Indexation rate	Employment rate of male aged 60 (2040) Indexation adjustment	Pivotal age
0	45.99	68.52%	99.05	68.52%	30
0.1	45.63	67.21%	99.04	66.89%	30
0.2	45.25	65.85%	99.02	65.17%	30
0.3	44.87	64.46%	99.01	63.45%	31
0.4	44.47	63.03%	98.99	61.64%	31
0.5	44.07	61.56%	98.97	59.85%	31

Table 4: Accrual and indexation reforms with work incentives near retirement

8 Conclusion

In this paper, we provide a first order approximation of the prospective consequences for all generations currently alive of different pension policies seeking to secure the long term budget balance of the PAYG pension schemes in an ageing population. The central finding of our simulation model is the tension between equality and democracy. Equality across cohorts requires in our model to adopt pension reforms minimizing the gap in the relative pension loss across cohorts currently alive. The relative pension loss is the change in the lifetime pension benefit relative to the no reform status quo. Our approach is in the spirit of generational accounting since we calculate how much in total each current and future retirees can expect to pay in terms of pension loss over their remaining expected lifetimes. We concentrate on incidence across cohorts, and so we assume representative agents within cohorts. We use a cross sectional prediction of future life-cycle income and employment profiles with updating for wage growth. We impose a term limit to the intertemporal budget balance to avoid the Ponzi perpetual roll over of the budget deficit to future generations.

We find that the indexation reform is preferable to the accrual reform both in terms of generational balance and efficiency, but that around 80% of the voters would oppose to the indexation reform. We find that as a result of the voting outcome, the youngest half of the cohorts currently alive will bear 85% of the total adjustment cost. We also show that it is possible to improve further the generational balance by combining accrual and indexation reform. In particular generational balance would require higher accrual rate combined with lower indexation rate to shift further the adjustment cost to the cohorts already retired. An alternative policy option would be to set higher indexation before retirement compared to after retirement. However these two policy options would be opposed by a majority of voters currently alive. We show that the tension between democracy and equality is robust to the introduction of unequal longevity within cohorts and also to the concern of work incentive for the seniors workers.

Our results are a first-order approximation of the prospective incidence of pension policies on all cohorts currently alive. To go further requires a more structural analysis of the impact of pension policy taking into account within cohort heterogeneity of lifetime income, employment and mortality profiles together with endogenous behavioral responses, by means of micro simulations. A central assumption that we made is that representative agent in each cohort is assumed to follow the same age profiles of mortality, earnings, employment and retirement which are the currently observed age profiles in the cross section data with updating for growth. This cross sectional prediction of life-cycle profiles is problematic when there is heterogeneity within cohorts. This is interesting avenue for future research.

References

Andersen, A.G., Markussen, S., Røed, K., 2021. Pension reform and the efficiency-equity trade-off: Impacts of removing an early retirement subsidy. Labour Economics 72, 102050.

Auerbach, A.J., Gokhale, J., Kotlikoff, L.J., 1994. Generational accounting: A meaningful way to evaluate fiscal policy. Journal of Economic Perspectives 8, 73–94.

Banks, J., Disney, R., Oldfield, Z., 1999. What can we learn about pension reform from Generational Accounts for the UK? Technical Report. IFS Working Papers.

Barr, N., Diamond, P., 2008. Reforming pensions: Principles and policy choices. Oxford University Press.

Blanchet, D., Bozio, A., Rabaté, S., 2016. Quelles options pour réduire la dépendance à la croissance du système de retraite français? Revue économique 67, 879–911.

Bommier, A., Leroux, M.L., Lozachmeur, J.M., 2011. Differential mortality and social security. Canadian Journal of Economics/Revue canadienne d'économique 44, 273–289.

Börsch-Supan, A.H., 2013. Entitlement Reforms in Europe: Policy Mixes in the Current Pension Reform Process. University of Chicago Press.

Brighouse, H., Fleurbaey, M., 2010. Democracy and proportionality. Journal of Political Philosophy 18.

Chen, T., Hallaert, J.J., Pitt, A., Qu, H., Queyranne, M., Rhee, A., Shabunina, A., Vandenbussche, J., Yackovlev, I., 2018. Inequality and poverty across generations in the European Union. International Monetary Fund.

Chetty, R., Stepner, M., Abraham, S., Lin, S., Scuderi, B., Turner, N., Bergeron, A., Cutler, D., 2016. The association between income and life expectancy in the United States, 2001-2014. JAMA 315, 1750–1766.

Cowell, F.A., 2016. Inequality and poverty measures. Oxford Handbook of Well-Being and Public Policy , 82–125.

Eggerickx, T., Sanderson, J.P., Vandeschrick, C., 2020. Mortality in Belgium from 19^{th} century to today. Quetelet Journal 8, 7–59.

European Commission, 2003. Joint report from the European Commission and Council on adequate and sustainable pensions.

European Commission, 2021. The 2021 Ageing Report: Economic and Budgetary Projections for the EU Member States (2019-2070). Publication Office of the European Union .

Fehr, E., Schmidt, K.M., 1999. A theory of fairness, competition, and cooperation. The Quarterly Journal of Economics 114, 817–868.

Fouejieu, A., Kangur, A., Martinez, S.R., Soto, M., 2021. Pension reforms in Europe: How far have we come and gone? Departmental Papers 2021.

Hernæs, E., Markussen, S., Piggott, J., Røed, K., 2016. Pension reform and labor supply. Journal of Public Economics 142, 39–55.

Hindriks, J., Myles, G., 2013. Intermediate Public Economics. The MIT Press,Cambridge.

Hohnerlein, E.M., 2019. Pension indexation for retirees revisited–normative patterns and legal standards. Global Social Policy 19, 246–265.

Kohli, M., Arza, C., 2011. The political economy of pension reform in europe, in: Handbook of aging and the social sciences. Elsevier, pp. 251–264.

Kotlikoff, L., 2003. Generational policy.

Kotlikoff, L.J., Burns, S., 2004. Generational Storm. What You Need to Know About America's Economic Future. MIT Press, Cambridge.

Miles, D., 1998. The implications of switching from unfunded to funded pension systems. National Institute Economic Review 163, 71–86.

Musgrave, R.A., 1981. A reappraisal of financing social security. Social security financing 89, 109–20.

Piggott, J.R., Sane, R., et al., 2009. Indexing Pensions. World Bank.

Porath, E.B., Gilboa, I., 1994. Linear measures, the gini index, and the income-equality trade-off. Journal of Economic Theory 64, 443–467.

Schmidt, U., Wichardt, P.C., 2019. Inequity aversion, welfare measurement and the gini index. Social Choice and Welfare 52, 585–588.

Sen, A., 1974. Informational bases of alternative welfare approaches: aggregation and income distribution. Journal of Public Economics 3, 387–403.

Whitehouse, E., 2009. Pensions, purchasing-power risk, inflation and indexation .

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